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BREEDING BIOLOGY OF THE FISCAL SHRIKE, *LANIUS COLLARIS* (LANIIDAE), IN A PERI-URBAN ENVIRONMENT IN ROMA (LESOTHO)

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Гнездовая биология сорокопута-прокурора, *Lanius collaris* (Laniidae), в окрестностях Рома (Лесото). Копий Г. — Изучена урбанизированная популяция сорокопута-прокурора в парковой и ландшафтной зонах у подножий Малоти (Драконовые горы). Уделено внимание ранее неизученным аспектам размножения, таким как ежегодная и межсезонная изменчивость репродуктивного поведения, а также поведение в процессе размножения в зависимости от плотности популяции и устойчивость поселений в связи с типом местообитания. Проанализированы выбор мест для гнездования и рацион питания.

Ключевые слова: *Lanius collaris*, урбанизация, размножение, питание, Лесото, южная Африка.

Breeding Biology of the Fiscal Shrike, *Lanius collaris* (Laniidae), in a Peri-Urban Environment in Roma (Lesotho). Kopij G. — An urbanized population of the Fiscal Shrike was studied in a park-like residential and landscape area at the foothills of the Maloti/Drakensberg region. Studies focused on these aspects of breeding ecology which have not been previously investigated, viz. year-to-year and intra-seasonal variations in reproductive performance, breeding performance in relation to population density, and site tenacity in relation to habitat type. In addition, nest site selection and diet was also analyzed.

Key words: *Lanius collaris*, urbanization, breeding, diet, Lesotho, southern Africa.

Introduction

The Fiscal Shrike *Lanius collaris* Linnaeus, 1758 is a characteristic bird species of urbanised habitats all over the Afrotropical Region (Harris, Franklin, 2000). So far, breeding ecology of this species in these habitats has been studied on the campus of the University of Zimbabwe in Harare, which consists of large gardens with extensive areas of lawns and exotic trees (Marshall, Cooper, 1969; Hargrove et al., 1972); on the campus of the University of Cape Coast, Ghana, which is a park-like residential and landscape area, with farmland and rough grassland (Macdonald, 1980); and on the campus of the University of the Free State in Bloemfontein, South Africa, consisting mainly peri-urban grassland (Kopij, 1999).

The present study was carried out in a park-like residential and landscape area at the foothills of the Maloti/Drakensberg region in southern Africa and was focused on these aspects of breeding ecology of the Fiscal Shrike which have not been previously investigated, viz. year-to-year and intra-seasonal variations in reproductive performance, breeding performance in relation to population density, and site tenacity in relation to habitat type.

Study area

The National University of Lesotho (NUL) campus, with the surface of 82 ha, was designed as the main study area. The campus is situated at Roma, 32 km E of Maseru, Lesotho, southern Africa (29°28'S; 27°44'E); at the altitude of 1 650 m a. s. l. The town Roma, which includes a few settlements (i. e.: the NUL campus, Thoteng, Mafekeng and Mafefoana), is nestled against foothills of the Moloti in a wide valley surrounded by sandstone cliffs. The valley is situated between the longitude 29°32'—29°26'S and the latitude

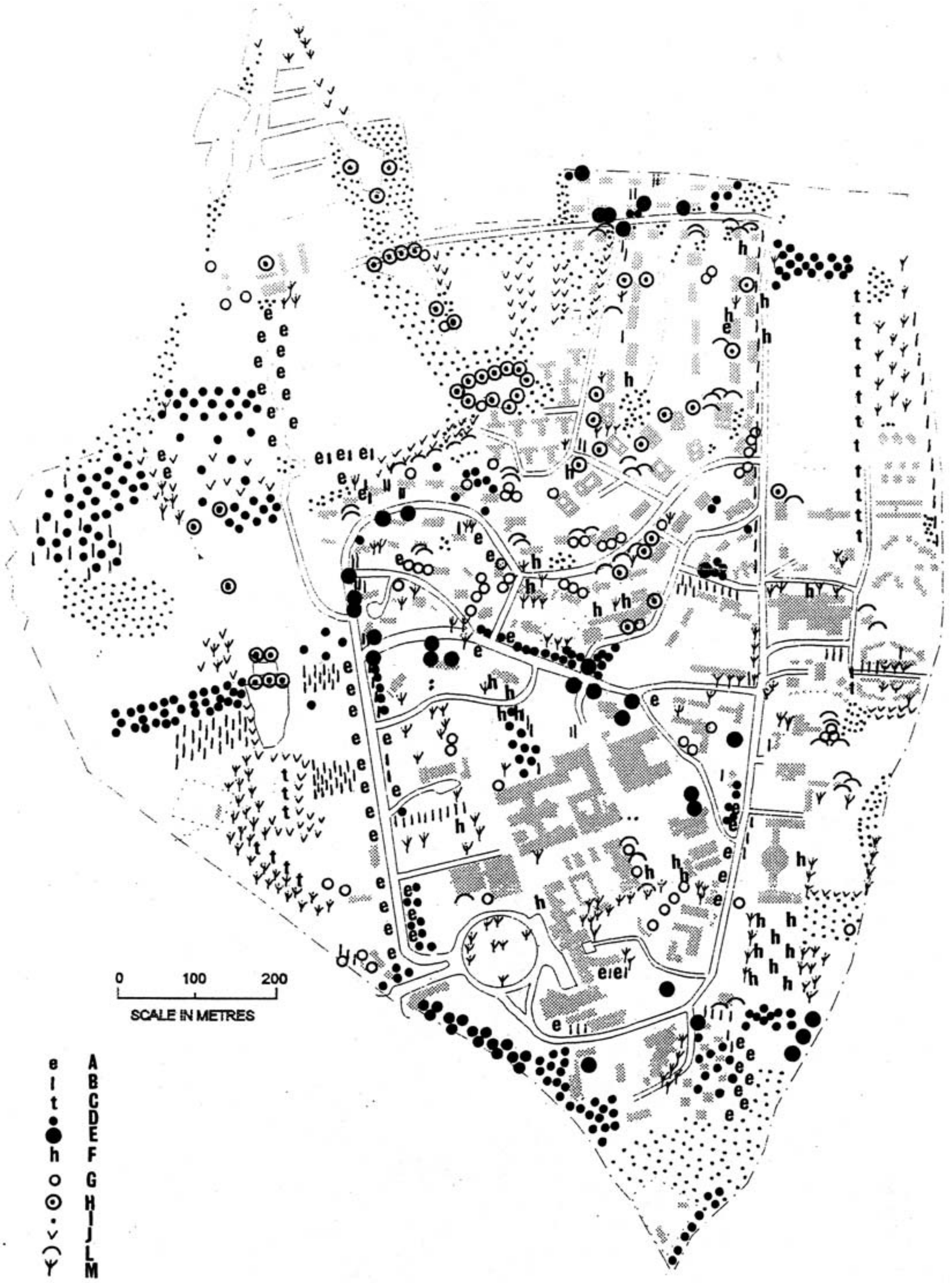


Fig. 1. The study area: shaded areas – buildings; double lines – roads; polygons – dams; A – cedars; B – pines; C – cypresses; D – young eucalypts; D – old eucalypts; F – oaks; G – poplars; H – willows; I – black wattles; J – cotoneasters and yellow fire-thorns; L – Persian lilac; M – other trees.

Рис. 1. Исследованная территория: затемненные участки – строения; двойные линии – дороги; многоугольники – запруды; A – кедр; B – сосна; C – кипарис; D – молодой эвкалипт; D – старый эвкалипт; F – дуб; G – тополь; H – ива; I – черная акация; J – кизильник и желтый боярышник; L – персидская сирень; M – другие деревья.

28°42'—28°48'E, at 1500 to 2000 m a. s. l. The major settlement in the valley, Roma, was founded in 1863, while the university was established in 1945. Latter two catholic seminaries, two high schools and a hospital were also funded. Around these modern buildings there is a striking rural setting, and cultivated fields further afield. The maize is the dominant crop. About 30 village settlements are located around the sandstone cliffs (Kopij, 2001).

The campus began as open grassland but at present it represents an urbanised habitat. There are 210 buildings of various size and height, tarred roads with a total length of c. 7 km, 12 oxidation dams varying in size from 10 to 100 ac, cultivated field of c. 2 ha and multitude of small gardens with vegetables, peaches and plums (Ambrose, Maphisa, 1999; Kopij, 2001). *Bromus uniloides* and *Paspalum dilatatum* are dominant grass species on the campus, and the following other were recorded: *Eragrostis curvula, Eragrostis plana*, *Helictotrichon turgidilum* and *Panicum laevifolium* (Ramalitse, 1990). The whole area of the campus is also well endowed with various exotic trees, such as gum trees *Eucalyptus* spp. (mostly *E. camaldulensis*), cedars *Cedrus atlantica*, pines *Pinus* spp. (mostly *P. radiata*), oaks *Quercus* spp. (mostly *Q. robur*), poplars *Populus* spp. (mainly *P. nigra* "*italica*" and *P. deltoides*), acacias *Accacia* spp. (mainly *A. dealbata*), peaches *Prunus persica*, she-oaks *Casuarina equiaetifolia*, false cypresses *Chamaecyparis* spp., cypresses *Cupressus* spp., weeping willow *Salix babylonica,* Persian lilac *Melia azedarach,* sweet chestnut *Castanea sativa*. In several places there are also clumps and hedgerows of cotoneasters *Cotoneaster* spp. and yellow fire-thorns *Pyracantha angustifolia* (fig. 1).

Lesotho climate has four distinct seasons, namely summer (November—January) characterised by high temperature and precipitation; winter (May—July) characterised by the lack of precipitation, warm temperature during the day and sudden drop after sunset; autumn (February—April) and spring (August—October) as transient periods between summer and winter. Both summer and winter weather pattern can occur in these two seasons. 75% of precipitation occurs between October and March (Sekoli, 1999). Rainfall during the years 1998—2001 and a long-term average monthly rainfall for Roma are shown in figure 2.

Methods

Studies were carried out in four consecutive breeding seasons (September—November) during the years 1998—2002. During the 2000/2001 breeding season the studies were conducted from September 2000 to April 2001.

Territories were identified and plotted by means of the mapping method (Bibby et al., 1992). The campus was divided into two parts: northern and southern. Counts were conducted in the morning in northern part and next morning in the southern part. Each counting lasted about two hours.

Since breeding season in the Fiscal Shrike extends in the Highveld from August to February (Kopij, 1999), nest-building lasts 3—8 days, incubation phase 15—17 days and nestlings remain in nest for 17—21 days (Harris, Arnott, 1988; Harris, Franklin, 2000; Kopij, 1999), it has been assumed that first brood in this species is in September—November, and the second one in December—February. In order to find differences in territory occupation within one breeding season, 4—8 counts were conducted in each of these four two-month-periods (September/October, November/December, January/February and March/April) during the 2000/2001 breeding season.

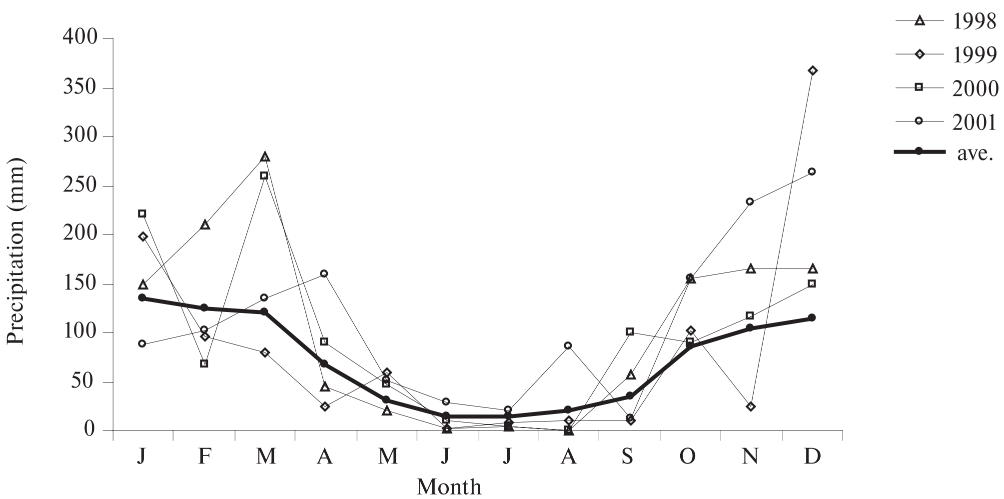


Fig. 2. Monthly rainfall in Roma during the years 1998—2000 and a long-term (1970—2000) average.

Рис. 2. Среднее количество дождей (по месяцам) в Рома за 1998—2000 и за 1970—2000.

Diet composition was determined through direct field observations, collection of impaled prey and pellet analysis. For this analysis, 31 pellets were collected on 28 September 1999 below a nest with chicks located in *Pyracantha* bush.

Results

Breeding density and site tenacity in relation to habitat type

During the years 1998—2001, the number of breeding pairs of the Fiscal Shrike varied in the study area (82 ha) from 26 to 36, i. e. 3.17 pairs per 10 ha to 4.39 pairs per 10 ha. The lowest territory density differed therefore from the highest one by 27.8% (Kopij, 2001, 2003).

Breeding season

Fiscal Shrike pairs started laying eggs in September and ended in January. A few pairs laid eggs in August and February. Two peaks in egg laying, in the first half September and in the second half of November, indicated two broods per year. The fledgling dates for the first broods extended from 29 September to 27 November, while the average fledgling dates varied from 23 October in 2001 to 13 November in 2000 (table 1). The overall average date of the fledgling for the first brood in all four consecutive years was 4 November (N = 38 pairs). The intervals between the first and the second broods varied from 27 to 73 days (x = 47.8 days, SD = 13.98, N = 21).

Nest construction and location

Materials most often used for nest construction were dry grass leaves and stems, *Helichrysum* herbs, sheep wool and paper. Lining material recorded included *Casuarina* needle-leaves, sheep wool and fine rootlets. Nests were located in various shrub (54.5%) and tree (45.5%) species, both broadleaved (86.4%) and coniferous (13.6%). These plants were predominately (95.5%) exotic species. Actually, only one nest (4.5%) was located in indigenous species (*Acacia karroo*). *Pyracatha angustifolia* appears to be the most frequently selected species (table 2). It is worthy to point out that although eucalypts, poplars and black wattles were dominant trees in the study area, no nests were found in these trees. Most nests (50%) were located in the height ranging from 2 to 3 m, five nests between 1 and 2 m (25%), three nests (15%) between 3 and 4 m, and only single nests at the height of 4.5 m and 6.5 m respectively. The mean nest height was c. 2.7 m (N = 20).

Table 1. Timing of breeding in the Fiscal Shrike
Таблица 1. Хронометраж размножения сорокопута-прокурора

Dates	1998/1999	1999/2000	2000/2001	2001/2002	Total
Earliest date of fledging in the first broods	3 Nov.	12 Oct.	7 Nov.	29 Sept.	29 Sept.
Latest date of fledging in the first broods	23 Nov.	27 Nov.	11 Nov.	11 Nov.	27 Nov.
Mean date of fledging in the first brood	6 Nov.	3 Nov.	13 Nov.	23 Oct.	4 Nov.

Table 2. Nest sites of the Fiscal Shrike
Таблица 2. Места гнездования сорокопута-прокурора

Tree/shrub species	N	N, %	Tree/shrub species	N	N, %
Pyracantha angustifolia	7	31.8	*Acacia robusta*	1	4.5
Pinus spp.	3	13.6	*Acacia karroo*	1	4.5
Casuarina aquiaetifolia	2	9.1	*Acacia* sp.	1	4.5
Prunus persica	1	4.5	*Ulmus parvifolia*	1	4.5
Ligustrum vulgare	1	4.5	*Rosa* sp.	1	4.5
Calistemon rigidus	1	4.5	*Cedrus atlantica*	1	4.5
Acacia dealbata	1	4.5	Total	22	100.0

Reproductive performance

Out of eight nests fund with incubated eggs, three contained three eggs, and four nests — four eggs. The mean clutch size was therefore 3.63 (SD = 0.52). Out of 20 families, there were three juveniles in five families (25%), two juveniles in 12 families (60%) and one juvenile in three families (15%). The mean number of juveniles per successful pair was therefore 2.1 (SD = 0.64). There was no statistically important difference (t-test = 0.426) in the mean number of juveniles per successful pair during the first breeding (October—November; x = 2.25, SD = 0.71, N = 8) and the second breeding (December—February; x = 2.00, SD = 0.60, N = 12). During the first breeding in spring (September—November) the proportion of pairs, which did not produce fledglings changed from 16.7 to 38.5% (table 3). The average proportion of pairs with fledglings from the first broods during the four consecutive breeding seasons was 29.7% (N = 128 pairs). Such proportion for the second brood was 49.3% in 2000/2001, and for 37.1% in 2001/2002 (average — 42.4%; N = 66; table 3).

Diet

Fiscal Shrikes were observed while preying upon juvenile bull frogs *Pyxicephalus adspersus*, dung beetles (Coleoptera, Scarabaeidae), locusts and katids (Orthoptera, Acrididae, Tettigonidae), and earthworms (Oligochaeta). In Fiscal Shrike territories, a number of prey were found impaled on thorns and wires, namely: locusts (Othoptera, Acrididae) (3 specimens), crickets *Gryllus bimaculatus* (Orthoptera, Gryllidae) (3 sp.), the elegant grasshopper *Zonocerus elegans* (Orthoptera, Pyrgomorphidae), dung beetles (Coleoptera, Scarabaeidae, Scarabaeinae) (3 sp.), fruit chafers (Coleoptera, Scarabaeidae, Cetoniinae) (4 sp.), a tenebrionid (Coleoptera, Tenebrionidae), the monarch butterfly *Danaus chrisippus* (Lepidoptera, Danaidae), a bug (Heteroptera) and a snail (Gastropoda). The analysis of pellets collected below a nest with chicks shown

Table 3. Proportion of pairs with fledglings
Таблица 3. Доля пар с оперившимися птенцами

Season	Brood	N of breeding pairs	N of pairs with fledglings	Proportion
1998/1999	First	26	10	38.5
1999/2000	First	36	6	16.7
2000/2001	First	31	10	32.3
	Second	31	15	49.3
2001/2002	First	35	12	34.3
	Second	35	10	37.1
Average		194	63	32.5

Table 4. Diet of Fiscal Shrike chicks based on pellet analysis
Таблица 4. Рацион питания птенцов сорокопута-прокурора (на основании анализа погадок)

Prey taxa	Frequency of occurrence	Percentage of prey items
Coleoptera	44.8	34.2
Scarabaeidae	41.9	21.4
Carabidae	9.7	5.7
Unidentified	16.1	7.1
Orthoptera	41.9	18.6
Dermaptera	25.8	12.9
Myriapoda	16.1	7.1
Reptilia (lizards)	16.1	7.1
Pyracantha seeds	9.7	20.0
Number of pellets analysed	31	
Number of items identified		70

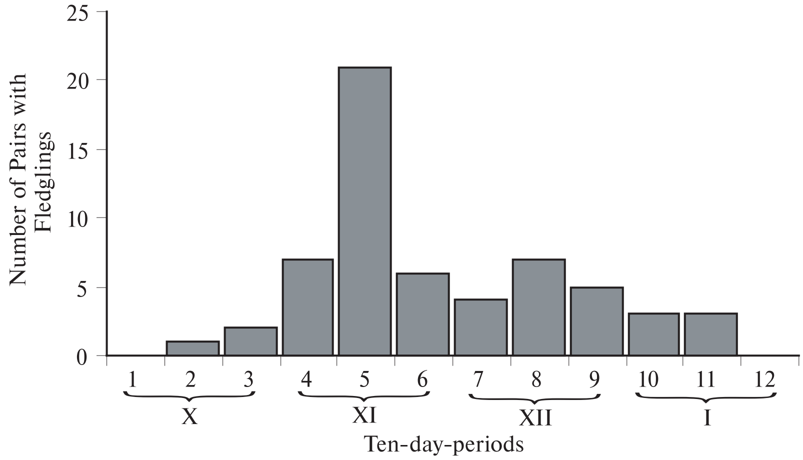


Fig. 3. The number of pairs with fledglings in the following 10-day-periods from October to January (1: 1—10 October, 2: 11—20 October, 3: 21—31 October etc.).

Рис. 3. Количество пар с оперившимися птенцами по декадам с октября по январь (1: 1—10 октября, 2: 11—20 октября, 3: 21—31 октября и т. д.).

that beetles and orthopterans constituted the staple food, while earwigs (Dermaptera), myriapods (probably diplopods), small lizards and *Pyracantha* fruits supplement the diet (table 4).

Discussion

Breeding season of the Fiscal Shrike at the Cape Coast, Ghana, continued throughout the year with two peaks, one in January/February and the other one in June/July (Macdonald, 1980). In Harare, the main breeding season was in September and October (Hargrove et al., 1972). Similarly, two peaks in breeding activity were recorded in Bloemfontein (Kopij, 1999) and in Roma (this study). This suggests that everywhere in Africa, most Fiscal Shrikes lay two clutches per year.

In Zimbabwe, nest height varied from 0.8 m to 12 m. The preferred height was between 1 m and 3 m, while nests above 6 m were usually in those places were no suitable sites in lower levels occurred (Hargrove et al., 1972). At the Cape Coast, most Fiscal Shrike nests (76%) were located between 1.8 m and 2.4 m. In Bloemfontein, 68% nests were situated between 1.0 and 2.0 m (Kopij, 1999). Therefore, at Roma nest were located at a similar height. Such situation was rather not expected. In urbanised habitats, human disturbance can markedly depress breeding success; birds therefore will show a tendency to locate nests on height not accessible for man. A lack of such tendency in all Fiscal Shrike populations studied in urbanised habitats may indicate that human factor does not influence significantly reproductive performance in Fiscal Shrikes.

Most nests in the urbanised habitats in Harare, Bloemfontein and Roma were located in exotic trees and shrubs, mostly against the main trunk (Hagrove et al., 1972; Kopij, 1999; this study). This could have been caused rather by the abundance of exotic and scarcity of natural tree/shrub species suitable for nesting sites, than by a real preference for the exotic tree/shrub species in the urbanised habitats.

Mean clutch size was 2.7 at Cape Coast, significantly higher at Roma — 3.6 and in the peri-urban grassland at Bloemfontein — 3.9 (Kopij, 1999). The mean clutch size may depend on the seasonal differences in habitat productivity. It seems that the larger is the difference the higher is the mean clutch size. Grasslands are characterised by much higher such difference than tropical forests.

Breeding success in the Fiscal Shrike varied from 10—17% at Cape Coast (MacDonald, 1980) and was markedly higher at Roma and in Bloemfontein, probably

due to relatively low number of natural predators in open grasslands and higher their number in more closed wooded areas.

On the University of the Free State the following invertebrate orders were recorded in the diet of the Fiscal Shrike: Coleoptera, Orthoptera, Hymenoptera, Diptera, Isoptera, Diplopoda, Solifugae and such vertebrates as small mammals, birds, lizards and frogs (Kopij, 1999). Similar groups of prey were recorded at Roma (this study) and on the University of Cape Coast (MacDonald, 1980). The Fiscal Shrike appears to be therefore an opportunistic feeder preying on any large invertebrates and small vertebrates available in its territory.

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